

MIL-STD-975M (NASA)

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546**

NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List

MIL-STD-975M (NASA)

1. This military standard is approved for use by all elements of the National Aeronautics and Space Administration and is available for use by all departments and agencies of the Department of Defense.
2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to:

MANAGER (310.A)
NASA PARTS PROJECT OFFICE
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

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FOREWORD

This standard is the technical baseline for standardization of Electrical, Electronic, and Electromechanical (EEE) parts. The intent of this effort is to focus part selection on EEE parts used in the design and construction of space flight hardware as well as mission-essential ground support equipment (GSE). The overall objective is to provide the designer with acceptable parts and specifications for procuring those parts for space flight missions. The result of this effort should provide the designer with EEE parts, including the necessary criteria pertaining to use, choice and applications.

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STANDARD PARTS

1. SCOPE

1.1 **General.** This standard provides a means of selecting, procuring and applying Electrical, Electronic, and Electromechanical (EEE) Parts for use in flight and mission-essential ground support equipment. The list is limited to the following Federal Stock Classes:

<u>Part Types</u>	<u>FSC</u>
* Capacitors	5910
* Circuit Breakers	5925
* Connectors	5935
* Crystals and Crystal Oscillators	5955
* Diodes	5961
* Fiber Optics	60GP (FSG)
* Filters	5915
* Fuses	5920
* Inductors	5950
* Microcircuits	5962
* Relays	5945
* Resistors	5905
* Thermistors	5905
* Transformers	5950
* Transistors	5961
* Wire and cable	6145

1.2 **Purpose.** The purpose of this standard is to provide equipment designers and manufacturers with electronic parts having quality levels considered to be most acceptable for flight and mission-essential ground support equipment.

1.3 **Classification.** Three levels of quality are used in this standard. Grade 1 parts are very low risk, higher quality and reliability parts intended for critical applications. Grade 2 parts are low risk, high quality and reliability parts for use in applications not requiring Grade 1 parts. Grade 3 parts are higher risk, good quality and reliability parts but are not recommended for applications requiring high product assurance levels.

2. REFERENCED DOCUMENTS

Issues of documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal form a part of this standard to the extent specified herein.

CAPACITORS (FSC 5910)

- | | | |
|-------------|---|--|
| MIL-C-20 | - | Capacitors, Fixed, Ceramic Dielectric (Temperature Compensating), Established and Non-established Reliability, General Specification for. |
| MIL-C-123 | - | Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable and General Purpose), High Reliability, General Specification for. |
| MIL-C-23269 | - | Capacitors, Fixed, Glass Dielectric, Established Reliability, General Specification for. |
| MIL-C-39003 | - | Capacitors, Fixed, Electrolytic (Solid Electrolyte), Tantalum, Established Reliability, General Specification for. |
| MIL-C-39006 | - | Capacitors, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, General Specification for. |
| MIL-C-39014 | - | Capacitors, Fixed, Ceramic Dielectric (General Purpose), Established Reliability, General Specification for. |
| MIL-C-55365 | - | Capacitors, Chip, Fixed, Tantalum, Established Reliability, General Specification for. |
| MIL-C-55681 | - | Capacitor, Chip, Multiple Layer, Fixed, Unencapsulated, Ceramic Dielectric, Established Reliability, General Specification for. |
| MIL-C-83421 | - | Capacitors, Fixed, Supermetallized Plastic Film Dielectric, (dc, ac, or dc and ac), Hermetically Sealed in Metal Cases, Established Reliability, General Specification for. |
| MIL-C-87217 | - | Capacitors, Fixed, Supermetallized Plastic Film Dielectric, Direct Current for Low Energy, High Impedance Applications, Hermetically Sealed in Metal Cases, High Reliability, General Specification for. |

CONNECTORS (FSC 5935)

- | | | |
|---------------|---|--|
| MSFC 40M38277 | - | Connectors, Electrical, Circular, Miniature, High Density, Environment Resisting, Specification for. |
| MSFC 40M38298 | - | Connectors, Electrical, Special, Miniature Circular, Environment Resisting. |
| MSFC 40M39569 | - | Connectors, Electrical, Miniature Circular, Environment Resisting, 200C, Specification for. |

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GSFC S-311-P-4 - Connectors (and Contacts), Electrical, Rectangular, for Space Flight Use, General Specification for.

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- GSFC S-311-P-10 - Connectors, Subminiature, Electrical and Coaxial Contact, for Space Flight Use.
- MIL-C-5015 - Connector, Electrical, Circular Threaded, AN Type, General Specification for.
- MIL-C-22992 - Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type, General Specification for.
- MIL-C-24308 - Connector, Electric, Rectangular, Miniature Polarized Shell, Rack and Panel, General Specification for.
- MIL-C-26482 - Connector, Electrical, (Circular, Miniature, Quick Disconnect, Environment Resisting) Receptacles and Plugs, General Specification for.
- MIL-C-83513 - Connector, Electrical, Rectangular Microminiature, Polarized Shell, Crimp and Solder Contacts, General Specification for.
- MIL-C-38999 - Connector, Electrical, Circular, Miniature, High Density, Quick Disconnect, (Bayonet, Threaded and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for.
- MIL-C-39012 - Connector, Coaxial, Radio Frequency, General Specification for.
- MIL-C-39029 - Contacts, Electrical Connector, General Specification for.
- MIL-C-55302 - Connectors, Printed Circuit Subassembly and Accessories, General Specification for.
- MIL-C-85049 - Connector Accessories, Electrical, General Specification for.

CRYSTALS & CRYSTAL OSCILLATORS (FSC 5955)

- MIL-C-49468 - Crystal Units, Quartz, Precision, General Specification for
- MIL-O-55310 - Oscillators, Crystal, General Specification for

DIODES (FSC 5961)

- MIL-S-19500 - Semiconductor Devices, General Specification for.

FILTERS (FSC 5915)

- MIL-F-28861 - Filters and Capacitors, Radio Frequency/Electromagnetic Interference Suppression, Specification for.

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INDUCTORS (FSC 5950)

- MIL-STD-981 - Design Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications.
- MIL-C-39010 - Coils, Fixed, Radio Frequency, Molded, Established Reliability, General Specification for.
- MIL-C-83446 - Coils, Chip, Fixed or Variable, General Specification for.

MICROCIRCUITS (FSC 5962)

- MIL-STD-883 - Test Methods and Procedures for Microelectronics.
- MIL-M-38510 - Microcircuits, General Specification for
- MIL-H-38534 - Hybrid Microcircuits, General Specification for
- MIL-I-38535 - Integrated Circuits (Microcircuits) Manufacturing, General Specification for

PROTECTIVE DEVICES (FSC 5920 and 5925)

- MIL-F-23419 - Fuses, Instrument Type, General Specification for
- MIL-C-39019 - Circuit Breakers, Magnetic, Low-Power, Sealed, Trip-Free, General Specification for.

RELAYS (FSC 5945)

- MIL-R-39016 - Relays, Electromagnetic, Established Reliability, General Specification for.

RESISTORS (FSC 5905)

- MIL-R-39005 - Resistors, Fixed, Wire-Wound (Accurate), Established Reliability, General Specification for.
- MIL-R-39007 - Resistors, Fixed, Wire-Wound (Power Type), Established Reliability, General Specification for.
- MIL-R-39008 - Resistors, Fixed Composition (Insulated), Established Reliability, General Specification for.
- MIL-R-39009 - Resistors, Fixed, Wire-Wound (Power Type, Chassis Mounted), Established Reliability, General Specification for.

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- MIL-R-39015 - Resistors, Variable, Wire-Wound (Lead Screw Actuated), Established Reliability, General Specification for.
- MIL-R-39017 - Resistors, Fixed, Film (Insulated), Established Reliability, General Specification for.
- MIL-R-39032 - Resistors, Packaging of.
- MIL-R-55182 - Resistors, Fixed, Film, Established Reliability, General Specification for.
- MIL-R-55342 - Resistors, Fixed, Film, Chip, Established Reliability, General Specification for.
- MIL-R-83401 - Resistor Networks, Fixed, Film, General Specification for.

THERMISTORS (FSC 5905)

- MIL-T-23648 - Thermistor (Thermally Sensitive Resistor), Insulated, General Specification for.
- GSFC S-311-P-18 - Thermistor (Thermally Sensitive Resistor), Insulated, Negative Temperature Coefficient, Style 311P18, Specification for.

TRANSFORMERS (FSC 5950)

- MIL-STD-981 - Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications.

TRANSISTORS (FSC 5961)

- MIL-S-19500 - Semiconductor Devices, General Specification for.

WIRE & CABLE (FSC 6145)

- MIL-C-17 - Cable, Radio Frequency, Flexible and Semirigid, General Specification for.
- MIL-W-5086 - Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
- MIL-W-22759 - Wire, Electric, Fluorocarbon Insulated, Copper or Copper Alloy.
- MIL-C-27500 - Cable, Electrical, Shielded and Unshielded, Aerospace.

OTHER DOCUMENTS

ASTM E 595 - Standard Test Method for Total Mass Loss and Collected Volatile Condensable Material From Outgassing in a Vacuum Environment.

MIL-HDBK-978 - Parts Application Handbook

NHB8060.1 - Flammability, Odor, Offgassing and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion.

(Copies of specifications, standards, drawings, and publications requested by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

NOTE: Additional copies may be obtained from the following center:

STANDARDIZATION DOCUMENTS ORDER DESK
BUILDING 4, SECTION D
700 ROBBINS AVENUE
PHILADELPHIA, PA 19111-5094

3. DEFINITIONS

3.1 **Standard Part.** An EEE part which is listed in Part I of this standard or is procured from a Part I listed flow in accordance with 4.4 herein.

3.2 **Nonstandard Part.** A part is considered nonstandard unless it meets either of the following criteria:

- a. the part is listed in part I of this standard or
- b. the part is procured from a part I listed flow for a Grade 3 application in accordance with section 4.4.2.

Grade 2 parts used in Grade 1 applications or Grade 3 parts used in Grade 1 or 2 applications are considered nonstandard.

3.3 **Grade 1 parts.** This is the classification used for standard parts intended for applications that NASA has determined to be critical. Grade 1 parts can also be used in applications designated as Grade 2 or Grade 3.

3.3.1 **Capacitors.** These are military established reliability (ER) parts purchased to either S or C failure rates except where specifically noted.

3.3.2 **Connectors.** These are connectors that are procurable to NASA/MSFC "40M" and NASA/GSFC "S-311" specifications.

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- 3.3.3 **Crystals and Crystal Oscillators.** There are no Grade 1 crystals listed in this standard. Crystal oscillators are Class S qualified to MIL-O-55310
- 3.3.4 **Diodes.** These are diodes that are MIL-S-19500 JANS qualified.
- 3.3.5 **Filters.** There are no Grade 1 filters listed in this standard.
- 3.3.6 **Inductors and Coils.** These are military established reliability (ER) parts purchased to S failure rate.
- 3.3. **Microcircuits.** The only candidates are MIL-I-38535 Appendix A JAN Class S qualified devices, MIL-I-38535 Class V qualified devices and MIL-H-38534 Class K qualified devices. Drawings for procurement are limited to one part-one part number SMDs, MIL-M-38510 detail specifications and MIL-H-38534 SMDs.
- 3.3.8 **Protective Devices.** There are no Grade 1 protective devices listed in this standard.
- 3.3.9 **Relays.** There are no Grade 1 relays listed in this standard.
- 3.3.10 **Resistors.** These are military established reliability (ER) parts purchased to S failure rate except where specifically noted.
- 3.3.11 **Thermistors.** These are thermistors that are procurable to NASA/GSFC specification S-311-P-18.
- 3.3.12 **Transformers.** This standard contains no transformers. All transformers must be procured to the requirements of MIL-STD-981.
- 3.3.13 **Transistors.** These are transistors that are MIL-S-19500 JANS qualified.
- 3.3.14 **Wire and Cable.** This is wire qualified to MIL-W-22759 or MIL-W-81381, and cable qualified to MIL-C-17 and MIL-C-27500.
- 3.3.15 **Photonics.** There are no Grade 1 photonics listed in this standard.
- 3.4 **Grade 2 parts.** This is the classification used for standard parts which meet the criteria for inclusion in this standard (see 4.1.1, 4.1.2 and for microcircuits, also see 4.2, herein) and are intended for applications not requiring Grade 1 parts, but still requiring high product assurance levels. Parts intermediate in quality between Grade 1 and Grade 2 may also be used in applications designated as Grade 2. (Example: If S failure rate is Grade 1 and P failure rate is Grade 2, parts with an R failure rate can be used in Grade 2 applications.) Grade 2 parts may be used in Grade 3 applications.
 - 3.4.1 **Capacitors.** These are military established reliability (ER) parts purchased to either P or B failure rate level.
 - 3.4.2 **Connectors.** These are connectors that are procurable to NASA/MSFC “40M,” NASA/GSFC “S-311”, MIL-C-5015, MIL-C-24308, MIL-C-26482, MIL-C-38999, MIL-C-39012, MIL-C-39029, MIL-C-55302, and MIL-C-83513 specifications.
 - 3.4.3 **Crystals and Crystal Oscillators.** There are no Grade 2 crystals listed in this standard.

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Crystal oscillators are Class B qualified to MIL-O-55310.

- 3.4.4 **Diodes.** These are JANTXV diodes that have been evaluated in accordance with the additional testing requirements of section 4 of Part I herein.
- 3.4.5 **Filters.** These are filters that are qualified to MIL-F-28861.
- 3.4.6 **Conductors and Coils.** These are military established reliability (ER) parts purchased to failure rate except where specifically noted
- 3.4.7 **Microcircuits.** The only candidates are:
 - a. MIL-I-38535 Appendix A, JAN Class B qualified devices, or
 - b. MIL-I-38535 Class Q qualified devices, or
 - c. MIL-H-38534 microcircuits processed on a Class K certified Line, but tested to an H assurance class.Drawings for procurement are limited to one part-one part number SMDs, MIL-M-38510 detail specifications or MIL-H-38534 SMDs
- 3.4.8 **Protective Devices.** These are devices that are qualified to MIL-F-23419/8 and MIL-C-39019/1 through MIL-C-39019/6.
- 3.4.9 **Relays.** These are parts qualified to MIL-R-39016 failure rate level (FRL) P.
- 3.4.10 **Resistors.** These are military established reliability (ER) parts purchased to P failure rate levels.
- 3.4.11 **Thermistors.** These are thermistors that are procurable to military control specification MIL-T-23648/19.
- 3.4.12 **Transformers.** This standard contains no transformers. All transformers must be procured to the requirements of MIL-STD-981.
- 3.4.13 **Transistors.** These are JANTXV transistors that have been evaluated in accordance with the additional testing requirements of section 13 of Part I herein.
- 3.4.14 **Wire and Cable.** This is wire qualified to MIL-W-22759 or MIL-W-81381, and cable qualified to MIL-C-17 and MIL-C-27500.
- 3.4.15 **Photonics.** To date, there are no Grade 2 photonics listed in this standard.
- 3.5 **Grade 3 parts.** This is the classification used for standard parts which may only be used in applications where risk of failure can be tolerated up to moderate levels or where failure risk cannot be mitigated by NASA (as described in 4.2.4). Grade 3 parts are considered nonstandard for use in Grade 1 or Grade 2 applications. Grade 3 parts must be procured as described in paragraph 4.4.2.
- 3.5.1 **Microcircuits.** Candidates must have been produced on a MIL-I-38535 certified and qualified manufacturing line. QPL-to-QML transitional flows are considered certified and qualified unless they fail full QML validation or qualification. No serious quality or reliability problems shall have been reported and verified against any part types produced on the MIL-I-38535 line. The Electronic Parts Information Management

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System (EPIMS), GIDEP and the NASA advisory system will be reviewed for any problems.

- 3.5.2 **Grade 3 parts other than microcircuits.** Other than microcircuits, there are no other parts designated as Grade 3.
- 3.6 **Preferred Nonstandard Parts.** These are EEE parts listed in Part II of this standard which are being considered for Part I listing.

4. GENERAL REQUIREMENTS

4.1 **Criteria for standard parts listing.** Paragraphs 4.1.1 through 4.1.2 define the criteria which must be met for listing most parts in Part I of this standard. All commodity groups and some microcircuits are covered by the criteria of 4.1. MIL-I-38535 Appendix A microcircuit criteria is found in 4.1. MIL-H-38534 and fully qualified and transitionally certified MIL-I-38535 microcircuit criteria is found in 4.2.

4.1.1 **Criteria for candidate parts selection.** A part will become a candidate for listing in this standard only if it meets all of the criteria in 4.1.1.1 through 4.1.1.4.

4.1.1.1 **Application need.** There must be multiple applications requiring the specific performance capability peculiar to the part proposed for listing. Consideration will be given to selecting parts capable of satisfying the widest range of design applications, and when applicable, parts should be compatible with existing listings (e.g., select a reference diode that is an extension of a listed series or a microcircuit that is generic to a family already listed). A definite need is assumed to exist for a part that has been used successfully in several recent space applications, if it is nonredundant (with respect to form, fit, or function) to existing listings or provides other compelling advantages (e.g., continuing availability) over such listings. In the latter case, deletion of the original listing may be in order.

4.1.1.2 **Technological maturity.** The design of the part must be finalized and must utilize proven materials and technologies. It must have been in production for a period sufficient to provide assurance that the critical design and process parameters have been identified and adequate controls have been developed. The technology also must have demonstrated suitability for flight hardware or mission-essential ground support equipment use.

4.1.1.3 **Availability of manufacturers.** The part should be in production by at least one and preferably two manufacturers whose previous performance indicates that they are capable of qualifying their product to specifications adequate for listing in this standard.

4.1.1.4 **Test or usage history.** There must be sufficient test or usage experience with the part to:

- a. Determine predominant failure modes and mechanisms.
- b. Provide reasonable confidence that the part will perform reliably when supplied to an adequate specification.
- c. Identify the derating and application restraints necessary for reliable use in flight hardware or mission-essential ground support equipment environments.

4.1.2 **Criteria for standard parts approval.** The criteria of 4.1.2.1 through 4.1.2.4 should be met before a candidate part can be approved and listed in this standard.

4.1.2.1 **Characterization data.** A comprehensive parameter characterization test program has been conducted to identify the part's performance capability through the operating temperature spectrum and over long life. This data must indicate

that the part parameters are stable during the operating temperature range and life, and must reveal peculiarities that should be considered or avoided in usage.

- 4.1.2.2 **Evaluation tests.** An environmental test program shall be conducted when required by the governing specification to determine actual stress levels at which the part fails or degrades significantly.
- 4.1.2.3 **Specification.** The part shall have an adequate government specification that defines performance, design, materials, quality controls, and test requirements. Parameters in the specification shall realistically characterize the part during its range of specified environment and operating conditions.
- 4.1.2.4 **Qualification.** The part should be qualified to the applicable specification, and this qualification must be maintained in accordance with qualification retention requirements. Some parts may be listed when there is an indication that a QPL listing is imminent. **QPL listing shall be reviewed by the user for latest qualification status.** Former MIL-M-38510 microcircuit qualification is now governed by Appendix A of MIL-I-38535 and approved parts are listed in QML-38535. At some point in time, these microcircuits may no longer be produced fully in accordance with Appendix A of MIL-I-38535. When this occurs, approved sources will be listed in section 7.2 of this document and must be used for procurement of MIL-M-38510 devices. Section 7.3 may contain equivalent QML standard parts as substitutes for MIL-M-38510.

- 4.1.3 **Standard part removal criteria.** A part listed in this standard may be removed for any of the following reasons:
 - a. The part becomes obsolete.
 - b. There are no longer any qualified or fully compliant sources available for the part.
 - c. The part is replaced with a functionally similar device having improved characteristics or better reliability.
 - d. The part exhibits reliability problems for which no economically adequate controls or screens have been developed.

- 4.2 **Criteria for listing standard QML Grade 1 and Grade 2 flows and parts.** The criteria of 4.2.1 through 4.2.5 shall be met before a candidate flow may be listed in Part I as Grade 1 or Grade 2 (unless otherwise noted). Grade 2 parts compliant to MIL-H-38534 must have been produced on a Part I, Grade 1 hybrid flow (to an H assurance class). For Grade 1 and Grade 2 flows, all parts approved for use as standard parts will be listed with the flow. Criteria for listing Grade 1 and 2 parts is found in paragraph 4.2.7.

- 4.2.1 **Technology need.** There must be multiple applications requiring the specific technology peculiar to the flow proposed for listing. Consideration will be given to selecting flows that produce parts capable of satisfying the widest range of design applications. A definite need to list a flow is assumed for flows that produce parts that have successfully been used in several space applications.
- 4.2.2 **Technology maturity.** Production of devices on the candidate flow must have been in operation for a period sufficient to provide assurance that the critical design and process parameters have been identified and adequate controls have been developed. The technology also must have demonstrated suitability for flight hardware or mission-essential ground support equipment use. Devices utilizing plastic packages or semiconductor materials involving GaAs are not acceptable for Grade 1 or Grade 2.

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- 4.2.3 **Certification and qualification.** Grade 1 flows must be certified and qualified in accordance with MIL-I-38535 to a "V" assurance class or MIL-H-38534 to a "K" assurance class. Grade 2 MIL-I-38535 flows must be certified to "Q" assurance class. Grade 2 MIL-H-38534 flows must be certified to a "K" assurance class. For all Grade 1 flows, the NPPO or its agents must have concurred with the validation results on certification critical findings, or must have performed an independent evaluation.
- 4.2.4 **QML manufacturer partnering with NASA.** In order to approve a QML manufacturer for supplying microcircuits as Grade 1 or Grade 2, the manufacturer must be receptive to having an active, working partnership with NASA. A working partnership includes the following elements: Note that some requirements only apply to Grade 1.
- a. The manufacturer must submit a written request to the NASA Parts Project Office (NPPO) which states their willingness to comply with the requirements of this paragraph.
 - b. Allowing NASA or its agents access to production and design facilities, personnel, and procedures to resolve problems or NASA concerns,
 - c. Providing the NPPO with copies of TRB status reports, (only applies to MIL-I-38535 and MIL-H-38534 option 4)
 - d. Submitting the Quality Management (QM) plan to the NPPO, (only applies to MIL-I-38535 and MIL-H-38534 option 4)
 - e. (Grade 1 only) Coordinating with the NPPO and providing advance notice of any proposed major changes to design, fabrication, assembly, packaging, testing or other critical areas.
 - f. (Grade 1 only) Involving the NPPO or its agents in the process of deleting, modifying or reducing screening and QCI testing. The NPPO or its agents will evaluate the vendor in accordance with the requirements of paragraph 4.5 of MIL-I-38535 or paragraph 30.2.5 of Appendix E of MIL-H-38534 for test optimization.
- The partnership will involve working with the NPPO and NASA space centers, as well as with NASA prime contractors. NASA is particularly sensitive to manufacturer process capability, product defect rates, failure rates, reliability and failure modes.
- 4.2.5 **Test data or usage review.** There must be sufficient test or usage experience with parts manufactured using the candidate flow. Predominant failure modes, failure mechanisms, derating and application restraints must be identified to assure reliable use in flight hardware or mission-essential ground support equipment environments. For Grade 1, manufacturers must have demonstrably low failure rates.
- 4.2.6 **Removal of flows.** A Grade 1 or Grade 2 flow may be removed from this standard for any of the following reasons:
- a. The flow was removed from QML-38535 or QML-38534.
 - b. The qualified flow has exhibited persistent, serious reliability problems affecting an

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array of parts for which no economically adequate controls have been developed.

- c. The supplier chooses to withdraw from partnering.

4.2.7 Criteria for listing Grade 1 and Grade 2 microcircuits

4.2.7.1 The following criteria must be met before a microcircuit can be listed as a Grade 1 part from an approved flow:

- a. The microcircuit must have been produced and tested on an approved, Part I listed, Grade 1 flow.
- b. The MIL-H-38534 microcircuit must be marked with a Class K assurance class designator.
- c. The MIL-I-38535 microcircuit must be marked with a Class V or S assurance class designator.
- d. There must be an approved one part-one-part number SMD for the device which contains explicit requirements for Class V or Class K, for MIL-I-38535 devices or MIL-H-38534 devices, respectively.

4.2.7.2 The following criteria must be met before a microcircuit can be listed as a Grade 2 part from an approved flow:

- a. The MIL-I-38535 microcircuit must have been produced and tested on a Part I listed, Grade 2 flow. The MIL-H-38534 microcircuit must have been produced and tested on a Part I listed, Grade 1 flow.
- b. The MIL-H-38534 microcircuit must be marked with a Class H assurance class designator.
- c. The MIL-I-38535 microcircuit must be marked with a Class Q or B assurance class designator.
- d. There must be an approved one-part number SMD for the device which contains explicit requirements for class Q or Class H, for MIL-I-38535 devices or MIL-H-38534 devices, respectively.

4.3 **Criteria for listing standard QML Grade 3 flows.** The criteria of 4.3.1 through 4.3.3 shall be met before a Grade 3 candidate flow may be listed in Part I. Individual approved part numbers will not be listed in Part I of this standard. Nevertheless, a part from a flow which meets the requirements of 4.3.5 shall be considered a Grade 3 standard part.

4.3.1 **Technology need.** There must be multiple applications requiring the specific technology peculiar to the flow proposed for listing. Consideration will be given to selecting flows that produce parts capable of satisfying the widest range of design applications. A definite need to list a flow is assumed for flows that produce parts that have successfully been used in several space applications.

4.3.2 **Reliability history and technology restrictions.** No evidence of serious, persistent quality or reliability problems shall have been reported and verified against the candidate flow, either independently within NASA (e.g., NASA Advisories), or through

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the GIDEP reporting system. Devices utilizing plastic packages or semiconductor materials involving GaAs are not acceptable as part of a Grade 3 flow.

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- 4.3.3 **Certification and qualification.** Flows must be certified and qualified in accordance with MIL-I-38535. QPL-to-QML transitional flows are considered certified and qualified unless they fail full QML validation or qualification.
- 4.3.4 **Qualified flow removal.** A Grade 3 flow may be removed from this standard for any of the following reasons:
- a. The flow was removed from QML-38535.
 - b. Parts produced in the qualified flow have exhibited serious, persistent reliability problems for which no economically adequate controls or screens have been developed.
- 4.3.5 **Parts from Grade 3 flows.** Parts procured from a Grade 3 listed flow which are marked with a "Q" certification mark are considered standard. Part numbers for Grade 3 applications will not be listed in this standard but may be obtained from qualified Grade 3 flow vendors. Note: There are no Grade 3 MIL-H-38534 microcircuits at this time.
- 4.3.5.1 **Grade 3 Parts.** Grade 3 parts from Grade 3 flows consist of one of the following types:
- a. M-level SMD parts marked with a "Q" certification mark.
 - b. MIL-STD-883, paragraph 1.2.1 compliant parts marked with a "Q" certification mark.
 - c. DESC Drawing parts marked with a "Q" certification mark.
- 4.4 **Parts procurement.** The user is responsible for procurement of Standard Parts.
- 4.4.1 **Correlation of circuit requirements and detail specification test conditions.** When an application condition varies from the detail specification test condition(s), it shall be the responsibility of the contractor (or hardware designer/builder) to establish a satisfactory correlation between the circuit requirements and the detail specification requirements.
- 4.4.2 **Specification and marking.** All parts listed in Part I or parts produced on Grade 3 flows listed in Part I must be procured to the applicable detailed specification and marked as described below.
- 4.4.2.1 **Microcircuit specifications.** Grade 1 microcircuits must be procured using either a one part-one part number SMD (to a V or S assurance class), a MIL-M-38510 detail specification (to an S assurance class only), or a MIL-H-38534 SMD (K assurance class only).
- Grade 2 microcircuits must be procured using either a one part-one part number SMD (to a Q or B assurance class), a MIL-M-38510 detail specification (to a B assurance class), or a MIL-H-38534 SMD (H assurance class) from a Grade 1 listed flow.

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Grade 3 microcircuits must be procured from a listed flow using:

- a. any of the above listed specifications (except a MIL-H-38534 specification) or
- b. a general SMD (M assurance class) or
- c. a DESC drawing or
- d. compliant MIL-STD-883 as described below.

Grade 3 microcircuits may also be procured without a specification when procuring a MIL-STD-883 compliant device (in accordance with paragraph 1.2.1 of MIL-STD-883); however, the device must be procured from a Part I listed flow and the device must be marked with a QML certification mark which signifies compliance with approved baselines. A "Q" certification mark must be on all Grade 3 devices.

4.4.2.2 **Specifications for parts other than microcircuits.** All parts other than microcircuits must be procured to a government or NASA approved specification.

4.4.2.3 **Marking.** Parts must be marked in accordance with the requirements listed below.

4.4.2.3.1 **Marking of microcircuits.** Grade 1 and Grade 2 microcircuits must be marked with either a JAN brand or a QML certification mark in addition to the specification marking. Approved abbreviations for these marks are also considered acceptable. Grade 1 and Grade 2 microcircuits bearing a QML certification mark or a JAN brand must also be marked with the applicable assurance class designator (e.g., S, B, V, Q, K or H).

Grade 3 parts which are procured using a government specification must be marked with a JAN brand or a QML certification mark. Grade 3 MIL-STD-883 compliant devices must be marked with a QML certification mark which signifies that the device was produced and tested in accordance with the approved baseline.

4.4.2.3.2 **Marking for parts other than microcircuits.** All parts other than microcircuits must be marked with the JAN brand (or approved abbreviation) or a NASA part number.

4.4.3 **Additional testing.** Appendix B herein defines the additional testing that is required for parts which do not fully meet the requirements for NASA programs. All parts indicated shall be subjected to these additional tests prior to use.

4.4.4 **QPL Qualified manufacturers.** Qualified manufacturers for Qualified Products List (QPL) parts are listed in the appropriate QPL. QPL-38510 has been deactivated and is contained as part of QML-38535. When purchasing QPL parts, the procuring activity shall solicit bids from sources listed in the applicable QPL or QML for the specific part. "Sole source" procurements are discouraged except when only one qualified source exists. The qualifying activity may be contacted to determine if qualification has been granted to

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additional manufacturers for the part under procurement subsequent to the publication of the current QPL, or if the previous qualification status of any listed manufacturers has changed.

The qualifying activity for most QPL's is the Defense Electronics Supply Center (DESC-EQ), Dayton, Ohio 45444.

4.4.5 **QML Qualified Flows.** Qualified flows from QML-38535 and QML-38534 for monolithic and hybrid integrated circuits, respectively, which meet the listing requirements herein appear in Part I of this standard. When procuring QML parts, QML-38535 and QML-38534 shall be reviewed for part types having acceptable drawings. When an acceptable drawing or MIL-STD-883 compliant device is not available, users are encouraged to work with DESC in creating an SMD.

4.4.6 **Receiving inspection.** Receiving inspection should be performed on Standard Parts or devices procured from listed flows and should include:

- a. Review of data shipped with parts for compliance.
- b. Part count.
- c. Inspection for part markings and external defects.
- d. Electrical measurement (100%) of critical parameters, except sampling which may be approved by NASA projects.

Adequate security, such as an environmentally controlled bonded storage area, should be provided for storing the received parts until use, to maintain their integrity and traceability.

4.5 **Parts application.** The Standard Parts listed herein must be properly applied by the user in order to give satisfactory and reliable performance. The equipment shall be designed so that it will meet the specified performance and reliability requirements when using Standard Parts. Standard Parts must be used only for those characteristics or parameters which are controlled by the applicable detail specifications. The use of Standard Parts, as required by this standard, does not relieve the contractor (or hardware designer/builder) of the responsibility for complying with all equipment performance and other requirements set forth in the applicable system/equipment specification and contract.

4.5.1 **Minimizing parts count.** The variety of Standard Part types used in space equipment design should be the minimum necessary to provide satisfactory performance, and the user should exercise all reasonable design choices to achieve this objective.

4.5.2 **Application guidelines.** The application guidelines provided in MIL-HDBK-978, "NASA Parts Application Handbook," are recommended.

4.5.3 **Parts derating.** To achieve high reliability and good performance, derating from the qualified maximum ratings is required. All parts shall be derated in accordance with the derating criteria in Appendix A or a NASA approved derating document.

4.6 **Nonstandard parts usage.** Nonstandard parts shall be used only after they are approved by the responsible government activity.

4.7 **Conflict of data.** In the event of conflict between the technical description of Standard Parts described in this standard and the applicable specification, the specification shall govern.

- 4.8 **Problem reporting procedure - Standardization Document Improvement Proposal, (DD Form 1426).** Consistent with the parts standardization program, the use of the attached Standardization Document Improvement Proposal (DD form 1426) is encouraged as a communicate for parts and commodity experience. Experience need not be restricted to problems which may lead to a part removal request, but may also include part or commodity additions to the standard. As a minimum, the “Remarks” paragraph should include the following (when appropriate): commodity ID, generic part number, user part number, and any pertinent data which may be of use for approving your request.

Reply to attention of:

MANAGER (310.A)
NASA PARTS PROJECT OFFICE
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

- 4.9 **Material test requirements.** Requirements imposed on materials to be used in the space environment (i.e., thermal vacuum outgassing, flammability, smoke, odor, toxicity) are application specific. EEE parts that are conformally coated by a material that meets project requirements do not need to be tested for compliance to those material requirements, if approved by the specific project.

PREFERRED NONSTANDARD PARTS

5. SCOPE

- 5.1 **General.** Part II of this standard establishes a list of nonstandard EEE parts which are preferred for use in flight and mission essential ground support equipment, when a standard part is not available for listing in Part I.
- 5.2 **Purpose.** The purpose of Part II is to provide equipment designers and manufacturers with a list of preferred electronic parts that are advanced microcircuits which have not yet become fully approved or parts in common use by NASA programs but are not available in Part I of this standard. This section is intended to encourage standardization of device types and specifications. In addition, potential program savings can be realized through shared qualification and other relevant data. The availability of this data will streamline the Nonstandard Part Approval Request (NSPAR) process for listed part types.
- 5.3 **Classification.** These parts do not carry any level of classification and require a Nonstandard Part Approval Request (NSPAR) prior to use on NASA programs.
- 5.4 **Beneficial comments** (recommendations, additions, deletions), inquiries about the parts listed (except Advanced Microcircuit Parts Listing) and any pertinent data which may be of use in improving Part II of this document should be addressed as follows:

MANAGER (310.A)
NASA PARTS PROJECT OFFICE
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

6. REFERENCED DOCUMENTS

See individual sections.

7. DEFINITIONS

- 7.1 **Preferred Nonstandard Part.** This is a part that does not meet all criteria for Part I listing as a standard part, but is being recommended for use to encourage standardization.
- 7.2 **NSPARS.** Nonstandard Part Approval Request, required for all parts in Part II of this standard.

8. **CRITERIA FOR PREFERRED NONSTANDARD PARTS LISTING**

8.1 **Listing criteria.** In order for a part to be listed in this section the following criteria must be met.

- (i) The part was/is listed in the Candidate Part List (CPL)
- (ii) Application need has been identified.
- (iii) A suitable specification must be available for procurement of the part
- (iv) Suitable NASA or government approved and NASA surveyed manufacturers exist
- (v) Successful qualification to the suitable specification must have been accomplished

8.2 **Removal of a nonstandard part.** A part may be removed from this section if serious quality or reliability problems have been found which are of general concern.

9. **REQUIREMENTS FOR USE.** All projects are responsible to ensure that their program parts requirements are met by these parts and procurement specifications prior to use. A NSPAR is required and NASA approval needed unless specifically waived by the program.

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